INDOOR AIR QUALITY IN CANADIAN HOMES: POLICY, REGULATORY AND CONSUMER EDUCATION ISSUES

Peter Russell
Canada Mortgage and Housing Corporation, Ottawa, Canada

Bruce M. Small
Small and Associates, Goodwood, Ontario, Canada

Abstract

There are a number of reasons to question whether regulation should be the primary means of dealing with indoor air quality problems. The nature of hypersensitivity to indoor pollutant exposures is such that any practical form of regulation may not address the population that is experiencing the greatest difficulty from indoor pollution. The primary conclusion is tnat a broad look at various limited forms of regulation and of alternatives to regulation should be undertaken. For example, consumer, industry and professional education represent important components of an overall solution and could in some cases be significantly more effective than regulation in reducing residential indoor air pollution and improving health. Many indoor air quality problems are not technically difficult to solve. Encouraging technical innovation in housing design and better communication of early warnings could forestall proliferation of construction methods that cause indoor air quality problems.

Regulation as a Partial Solution to Indoor Air Quality Problems

It has been assumed by many that regulation will play a major part in the overall solution to residential indoor air quality problems. The nature of those problems and of the health effects involved indicates that there are many reasons to question whether regulation of products or materials should be considered the primary means for achieving reductions in residential indoor air pollution.

Fact - 'Indoor air quality' is a general term referring to a diverse set of problems. Each has its own characteristics; each may affect a distinct sub-population; each may be best addressed by a different set of solutions.

The use of volatile hobby products is a problem of different character and scope than the leakage of combustion products from furnaces and stoves. In the latter case, regulation of combustion devices, and of the design, installation and inspection of them might help to reduce the incidence of illness or death due to leakage of combustion products. In the case of hobby products, limited forms of regulation, such as banning extremely hazardous products and mandatory labelling of others, may help prevent outright poisonings. But more intensive education of users of such products may be absolutely necessary if low-level damage due to inadequate ventilation or other misuse is to be avoided.

Fact - Residential indoor air quality problems are often multi-causal. Regulation of a few products and materials without regard to other pollution sources, such as consumer activities, may fall short of reducing illness related to indoor exposures.

A home built of materials meeting the strictest emission standards can be rendered hazardous to the health of the occupants by consumer activities such as smoking, or by using volatile household cleaners or deodorizers. While regulations may play a part, they must be incorporated in an overall set of solutions, and the occupant must be recognized as an important determinant of the indoor atmosphere.

Fact - There is a wide variation of tolerance to chemical and biological indoor air contaminants within the population. Some people have become hypersensitive to even low-level exposures to a large number of chemical and biological pollutants.

Regulations are usually built on standards which indicate a rate of emission that is not to be exceeded by a material, or a resulting maximum acceptable pollutant concentration that is not to be exceeded. To be practical, the limits must be suitable for the majority of the population.

However, high-risk and hypersensitive sub-populations include individuals who may be affected at or below these limits. These individuals may represent a significant proportion of the people reporting illness in homes, and a regulation that does not address this core group may fall short of reducing incidence of such illness. Yet setting standards at levels which recognize this group's needs may impose unrealistic construction penalties on the majority.

Fact - In contrast to other handicapped groups, the hypersensitive population is not a static one. Tolerance of chemical pollutants will vary considerably, even in one individual, with changes in age, nutritional condition, infection and other stress. Different risk factors also predispose different subgroups to be more susceptible to different individual pollutants (e.g. heart disease and carbon monoxide).

If the sub-populations affected by pollutants were relatively static, it might be possible to sort the population into different groups and ensure that housing were available to match their different pollutant tolerances. But this is not the case -- any one family may contain a wide variation in tolerances, and this range will change with time as children are born and grow, as everyone ages, etc. Evidence also indicates that chemical overexposure can trigger a state of hypersusceptibility in some persons who would appear to have no predisposing factors such as a history of allergy or family history of disease.

Fact - Persons sensitive to one pollutant are often sensitive to a number of others.

Choosing one or two key pollutants (e.g. carbon monoxide, carbon dioxide, formaldehyde, etc.), and regulating them where possible could certainly be an important step in reducing risk from poor indoor air quality. Yet this action alone may fall short of reducing existing illness to the degree that might be expected, because those who have already been sensitized often react to a wide variety of pollutants at extremely low levels of exposure. Some attention should be paid to the problem of lowering overall exposure loads, particularly for those who already experience adverse symptoms. This may be better achieved by education and technical innovation rather than regulation.

At least two kinds of adaptation in housing may be required in the future:

1. Availability of a Variety of Homes Firstly, because there are persons who have become extremely susceptible to low-level exposures, there will always be a requirement for special housing which meets their specific needs. This is similar to the need to have some dwellings accessible to persons in wheelchairs. Not all dwellings, however, need be built to these special standards.

2. Adaptability of Any One Home Secondly, it appears desirable that the climate and air quality control in any home be designed to be adaptable for a relatively wide range of pollutant tolerance among occupants, since their sensitivities may change over time and occupancy may change. This flexibility might also minimize the induction of hypersensitivity in persons who are presently healthy, by minimizing indoor pollutant exposures for the general population.

Alternatives to Regulation

To investigate alternatives to regulation, three aspects of indoor air quality may be considered:

1) sources
2) methods of transmission
3) effects on people

An effective set of solutions to indoor air quality problems may include a balance of actions in all three areas (e.g. regulation of products, ventilation of homes, and medical treatment of hypersensitive individuals).

Medical Research to Reduce Susceptibility

For example, some reports indicate that nutritional therapy and therapy to reduce infection caused by fungal agents have led to a decrease in the chemical hypersensitivity in some people.

While such developments in medical research might not alter the need for major reductions in indoor air pollutants in many homes, they may reduce the need for specialized housing in which pollutant levels must be far lower than those normally well tolerated by the general population.

It is important to note that people may acquire a state of intolerance to common exposures in the home that they previously tolerated well. Often it is not the home environment itself that appears to have triggered this state -- hypersensitivity may accompany viral infection, fungal infection, nutritional deficits, drug use, chemical exposures outside the home, and other events. Therefore even the basic focus on the indoor environment as a cause of illness, rather than merely as a symptom of illness in some cases, requires re-examination.

Technical Innovation in Housing Design

It is sometimes assumed that construction techniques which will reduce indoor air pollution are costly, impractical for general application, and incompatible with energy conservation.

There are, however, a number of techniques that could significantly reduce risk of indoor air pollutant exposure, but that are quite compatible with energy conservation and could prove both practical and cost-effective in general construction.

These include:

- o effective separation of house and combustion device air flows
- o provision of a continuous, repairable internal air barrier
- o provision of a fail-safe fresh-air ventilation system with variable control, combined with heat reclamation from exhaust air
- o use of low-emission materials and furnishings

These techniques are discussed in more detail in a separate paper. The conclusion in this context, however, is that continued research, with the goal of developing techniques which meet all these criteria, could provide the physical means to reduce indoor air pollution problems, and avoid what may ultimately prove to be unnecessary debate about compromises among health, economics and energy conservation.

Limited Forms of Regulation

There are also various limited forms of regulation, short of mandatory control, which may be useful in addressing indoor air quality problems. Two examples are voluntary regulation and regulated education.

Voluntary Regulation - Voluntary regulations formulated by industry or by non-government agencies can be effective in promoting a uniform and safe product standard. Organizations such as the Canadian General Standards Board and the Canadian Standards Association in Canada establish country-wide standards that are followed widely in industry and often adopted in building codes at the municipal level.

Regulated Education - Regulations can be used to enforce specific labelling of products, so that the consumer can be made aware of certain constituents or offgassing substances. Examples include warning labels on solvent-containing sealing compounds and outgassing standards met by different grades of particle board.

It can also be helpful to require registration and education of trades involved in construction or renovations. For example, in Canada the contractors who are carrying out remedial work in houses containing Urea-Formaldehyde Foam Insulation (UFFI) must have completed a training program, dealing not only with procedures to remove UFFI but how to neutralize the impregnation of wood with formaldehyde. They are also taught how to protect themselves and others during the process.

Education -- a Complement to Regulation

Education of householders and others to the state-of-the-art in indoor air pollution management need not be postponed, notwithstanding the gaps in our knowledge. This approach to indoor air quality improvement has the advantages that individual circumstances can be taken into account, and that individual choices and freedoms are not restricted.

Possible consumer actions include:

- o use of less volatile cleaning products
- o use of safer pest control methods
- o storage in outbuildings of solvents and other products which may leak trace amounts from their containers
- o control of humidity in order to reduce microbiological populations (e.g. dust mites, moulds)
- o use of low-outgassing furnishings
- o use of low-outgassing materials in renovation projects
- o increased ventilation of hobby activities
- o regular maintenance of combustion equipment and periodic checking to ensure adequate combustion air supply

Other groups such as landlords, builders, architects, engineers, manufacturers, physicians, medical researchers, and public health officials might also play a part, and educational material for these groups may prove important.

A number of the indoor air quality problems that have arisen are not technically difficult matters to deal with. They have become 'problems' because they have not been adequately recognized until the conditions that caused them have been reproduced over and over in the housing stock.

For example, tightening housing without specific provision for adequate air to combustion devices can lead to dangerous conditions in which furnaces may backdraft and carbon monoxide may accumulate and cause illness or death. It is important that people be educated to recognize this situation as a potential cause of illness and possible fatality.

More organized means of gathering 'early warnings' from the consumer and from professionals such as physicians, who see the early effects of indoor air quality problems, could also short-circuit major problems.

Conclusions

A broader look at limited forms of regulation and at alternatives to regulation should be considered. Consumer, industry and professional education has an important part to play in the overall network of solutions to indoor air quality problems. Further technical innovation in housing design could help to avoid the need for compromises among health, air quality and energy conservation.